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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/483,569	01/14/2000	Stehpen S. Oh	TI-23373	8551

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EXAMINER

SMITS, TALIVALDIS IVARS

ART UNIT	PAPER NUMBER
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2654

DATE MAILED: 10/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No. 09/483,569	Applicant(s) Stephen S. Oh et al.
Examiner Talivaldis Ivars Smits	Art Unit 2654

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE three MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on Aug 26, 2002

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-22 is/are pending in the application.

4a) Of the above, claim(s) 4, 5, 7, 8, 12, 13, 15, and 16 is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-3, 6, 9-11, 14, and 17-22 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some* c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) The translation of the foreign language provisional application has been received.

15) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892) 4) Interview Summary (PTO-413) Paper No(s). _____

2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) Notice of Informal Patent Application (PTO-152)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) Other: _____

DETAILED ACTION

Response to Amendment

1. In response to the Office Action mailed May 29, 2002 applicants have submitted an Amendment filed August 26, 2002, amending the Abstract and Specification, and adding new claims 17-22, without adding new matter, as well as canceling claims 4, 5, 7, 8, 12, 13, 15, and 16 and arguing to traverse the claim rejections.

Response to Arguments

2. Applicant's arguments have been fully considered but they are not persuasive.

3. While it is true that Bloebaum *et al.* do not go into the details of their framing operation, (per Amendment, p. 7), nevertheless, technically *any* framing inherently involves windowing, at least the use of a rectangular window. However, one doubts that Bloebaum *et al.* are using such a trivial window, since it is well-known to produce spectral leakage problems and resultant spectral shape distortion, so that some nontrivial window is practically certain to be inherent in their FFT processing. In any case, an artisan at the time of invention would have known to actually multiply the selected samples by a window function having lower spectral sidelobe levels, so as to minimize the spectral leakage.

4. As for previous use of a Hanning window in noise suppression involving FFT processing

(Amendment, p. 8), this is taught, *inter alia*, in examiner's listed Borth *et al.* prior art noise suppression Patent references (e.g., U.S. Patent 4,628,529, col. 4, lines 10-17, issued back in 1986).

5. As for applicants' recited "selecting half of the transformed windowed signals" (Amendment, p. 8), this would, at the very least, have been *suggested* to an artisan at the time of invention by the Bloebaum *et al.* allusion to the "complex symmetry" of a DFT for "real-valued input signals such as audio", and the resultant feasibility of a "single-sided, frequency-domain representation", mentioned in examiner's cited col. 5, lines 8-10, and also cited by applicants' Amendment.

6. As for "smoothing the power estimate over time" (Amendment, p. 9), this is certainly not the same as the smoothing in the frequency domain referred to by applicants' (Amendment, p. 10). However, the examiner was, first of all, referring to the first-order *autoregressive* (AR) smoothing (in col. 5, lines 37-44) which (in the equation of col. 5, line 40) teaches smoothing of a (further processed) spectral filter output vector S "from a Transform and Filter Computation block" (col. 5, line 44-45) for adjacent frames that necessarily involves smoothing in the time domain. Admittedly, examiner's unnecessary further reference to the existing *additional* frequency-domain smoothing (col. 5, lines 60-65), quoted from by applicant, confused the issue. Sorry.

7. As for “adding the sampled speech signal to a portion of the speech signal of a previous frame” (Amendment, p. 10), this, with the “portion” equal to half the frame duration, is the notoriously well-known method for “unwindowing” after inverting the Fourier transform of Hanning-windowed time samples (mentioned in connection with claims 3 and 11 in the previous Office Action). Therefore it would have been obvious to do this for an artisan at the time of invention, so as to obtain back the original signal time series samples from their Digital Fourier Transform for further processing.

That a raised cosine added to a half-period (also half-frame) delayed raised cosine becomes a equivalent to a constant (rectangular) window can be seen by noting the notoriously well-known fact that a half-period delayed cosine is exactly 180 degrees out of phase with an undelayed cosine, so that their sum is zero, while the constant (“raised”) parts of the raised cosines add to a constant.

8. As for “increasing a noise spectral estimate by a small margin” (Amendment, p. 11), the examiner explained why Bloebaum *et al.* imply this in the previous Office Action (in connection to claims 6-8 and 14-16, which rejection is repeated, *mutatis mutandis*, in view of the cancellation of claims 7, 8, 15, and 16, below) in terms of their gain function, which cited Bloebaum *et al.* formula (col. 6, line 15) results in just such an increase, because it is used to compute signal power (col. 6, lines 29-35) and since, for a given total power, a smaller signal power at a given frequency implies a larger noise power estimate therefor.

9. For the above reasons the art rejections of the still pending original claims are repeated from the previous Office Action, next.

Claim Rejections - 35 USC § 103

10. The text of the section of Title 35, U.S. Code not included in this action can be found in the previous Office Action.

11. Claims 1-3, 6, 9-11, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leland S. Bloebaum *et al.* (U.S. Patent 6,070,137, filed January 7, 1998).

As per claims 1 and 9, Bloebaum *et al.* teach windowing (framing) and Fast-Fourier-Transforming a received stream of sampled acoustic signals (col. 5, line 11), computing a power spectral estimate (col. 5, lines 17-18), using only half the Fourier-transformed data (single-sided) because of the complex-conjugate symmetry of a Fast Fourier Transform of real signals alluded to (col. 5, lines 8-10), smoothing the power estimate over time when there is no speech to calculate a noise power estimate (col. 5, lines 37-44 and 60-65), calculates a gain function (enhancement filter, col. 6, lines 8-10) from the signal and noise power estimates, calculating a transformed signal by multiplying the transformed window signal by the gain function (col. 6, line 35-41).

Bloebaum *et al.* are interested in speech (voice) *coding* rather than speech *decoding*, and thus do not explicitly teach calculating an (enhanced) speech signal by doing an inverse FFT on the transformed window signal. However this is suggested by them, since an artisan at the time of

invention would have known, from her digital signal analysis course, to inverse-FFT the transformed enhanced speech signal to obtain back a time-domain version thereof, for playback to the listener.

As per claims 2 and 10, Bloebaum *et al.* do not teach a frame size of 32 samples. However, it would have been obvious for an artisan at the time of invention to use a “power of two” sample size to enable FFT processing, and 32 samples would correspond to somewhere between 5 and 2.5 milliseconds of speech data, one of the standard speech frame sizes (5, 10, 20 milliseconds). It would have been obvious for an artisan at the time of invention to use standard speech frame sizes so as to enable her to use conveniently-available standard signal processing hardware and software.

As per claims 3 and 11, Bloebaum *et al.* do not say what inherent window they are using. However, an artisan at the time of invention would have known to use a Hanning (raised cosine) window because of its notoriously well-known convenience of enabling “unwindowing” by addition after inverse FFT when using 50 percent Hanning time window overlap.

As per claims 6 and 14, Bloebaum *et al.* suggest increasing a noise spectral estimate by a small margin in the gain function (col. 6, lines 15-21, with $r=1$, $s=1$. and “others are not outside the scope of this invention”); their parameter η being in effect subtracted from the total power, and thus implies increasing the necessarily subtracted noise spectral estimate by a small margin.

12. New claims 17-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bloebaum *et al.* as applied to claims 1 or 9, in view of Murtaza Ali (U.S. Patent 6,144,937, filed July 15 1998).

While Bloebaum *et al.* do not address the issue of limiting the increase and decrease of their noise estimate, nor teach the recited limits therefor, Ali does both, by disclosing that his “noise power estimate...is clamped...so as not to increase at a rate faster than 3 dB per second nor decrease at a rate faster than 12 dB per second” (col. 14, lines 14-17).

It would have been obvious for an artisan at the time of invention to thus limit increases in estimated noise levels, because Ali teaches that due to the nature of speech and noise “It is...desirable that the noise power estimate...not be rapidly modified by a speech segment” while “it is desirable that the noise power estimate...rapidly decrease with a decrease in signal such as the end of a speech interval” but, by implication, without being excessive (col. 14, lines 18-30).

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Any response to this action should be mailed to:

Box AF
Commissioner of Patents and Trademarks
Washington, D.C. 20231

or FAXed to:

(703) 872-9314 (please label *official* communications
“EXPEDITED PROCEDURE”; please label *informal* or
draft communications “PROPOSED” or “DRAFT”)

Hand-delivered responses should be brought to Crystal Park 2, 2121 Crystal Drive,
Arlington, VA, Sixth Floor (Receptionist).

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, Talivaldis Ivars Smits, whose telephone number is (703) 306-3011. The examiner can normally be reached Mondays-Fridays from 8:30 a.m. to 5:00 p.m.

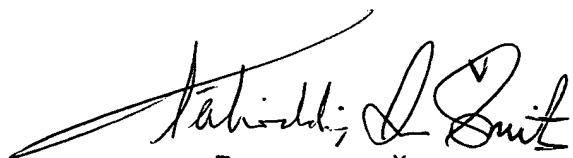
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marsha D. Banks-Harold, can be reached on (703) 305-4379. The facsimile phone number for Technology Center 2600 is (703) 872-9314.

16. Any inquiry of a general nature or relating to the status of this application should be

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directed to the Technology Center 2600 customer service, whose telephone number is (703) 306-0377.



TALIVALDIS MARS SMITS
PRIMARY EXAMINER

Art Unit 2654
October 24, 2002